EQUIPMENT REVIEW

Yamaha LPX-510

Affordable Performance LCD Video Projector

BILL CUSHMAN

High Contrast, High Accuracy Front Projection

The Yamaha LPX-510 is the latest high performance LCD projector from Yamaha. It offers many unique and truly useful features that provide great flexibility in installation and usage. It has the highest contrast ratio of any LCD projector I have tested, and it was accurately calibrated from the factory. It delivers a beautiful picture and is an excellent value ($5,495) for demanding home theatre applications.

Description

The Yamaha LPX-510 uses three 1280 x 720 pixel, 0.7-inch, 1.78:1 polysilicon TFT active matrix LCD panels manufactured by Epson. It has a short throw zoom lens with some unusual and highly desirable features. The lens has a large zoom ratio of 1:1.5 and offers both vertical and horizontal lens shift. This allows placement anywhere in front of the screen (actually a little below the screen in floor installations or a little above the screen in ceiling installations). The large zoom range gives a throw distance of 1.35 to 2.00 times the screen width. Focus and zoom are motorized. Horizontal and vertical shift are manual but are easily accessed from the top of the projector.

"It is a breakthrough product offering wonderful flexibility of placement, truly useful features, comprehensive menu selections, excellent contrast, and terrific as-recieved calibration"

The light source is a 200-watt UHE lamp that has adjustable power levels from 100 percent to 75 percent. An internal cinema filter balances the light beam in most operational modes and operates automatically as the picture modes are selected. An adjustable iris is also provided (from 100 percent to 75 percent) to improve black level and enhance contrast ratio.

The projector is about 17 inches wide, 13 inches deep, 6 inches high, and weighs 14 pounds. Both it and the remote control have a silver metallic finish. All connections are made to the back panel. Eight chromed buttons plus an x-y rocker ring and two status lights are located on the top of the projector. The ergonomically designed remote has 22 buttons, a depressible four-way x-y wobble pad, and a two-way backlight paddle. The backlight paddle is exceptionally easy to locate in the dark, but illuminates only the five main control buttons for simplicity of operation. To aid in proper adjustment a crosshatch and gray scale test pattern may be selected from either the projector or the remote. A double push of the

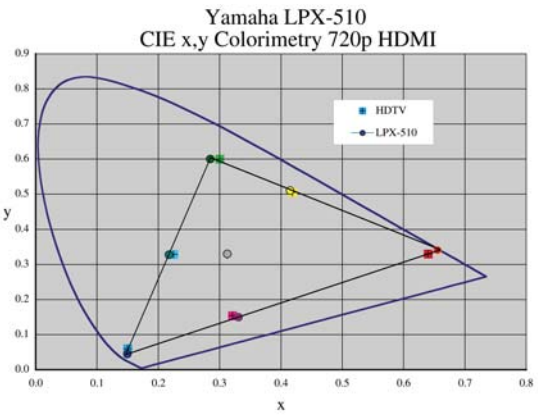
Yamaha LPX-510 LCD Video Projector

Specifications:

Device: 0.7 inch HTPS TFT x 3
Pixels: 1,280 x 720
Projection Lens: F=2.1 - 4.3, f=1.4 - 31.7 mm, zoom motorized: x 1.5
Lens Shift: Vertical up: 100%, down: 50%, horizontal left/right 50%
Motorized Iris: 100% - 75%
Projection Ratio: 1.355 - 2.038
Screen Size: 30-300 inch (16.9)
Lamp: 200W-150W UHP; 1,700 hours (200W continuous); 3,000 hours (150W continuous)
Brightness: 1,000 ANSI lumens (iris: off, Cinema Balance Filter; off) 350 ANSI lumens (iris: fully on, Cinema Balance Filter: on)
Contrast Ratio: 1200:1 (iris: 75%, Cinema Balance Filter: on) 1000:1 (iris: 100%, Cinema Balance Filter: on)
Color Format: NTSC, PAL, SECAM, NTSC 4.43, PAL-M, PAL-N and PAL60
Compatible Signal: 480i, 480p, 576i, 576p, 720p, and 1080i
PC Signal: SVGA, XGA, MAC13", MAC16, MAC19", iMAC VGA, iMAC SVGA
HDMI Input: 480p, 576p, 720p, 1080i Digital YPbPr and Digital RGB
Fan Noise: 27dB (lamp power min.); 34dB (lamp power max)
Power Consumption: 290W
Dimensions (WHD In Inches): 17-5/16 x 5-3/8 x 12-5/8
Weight (In Pounds): 13.9
Price: $5,495

Manufactured In Japan For:

Yamaha Electronics Corporation, USA
6660 Orangethorpe Avenue
Buena Park, California 90620
Tel: 714 522 9105
www.yamaha.com/yec



power button is required to turn off the projector to avoid accidental turn-off, which would reduce bulb life.

The Owner's Manual is unusually thorough and is almost completely devoid of marketing hype. It offers many suggestions that will help the average user extract maximum performance from the projector.

Inputs And Signal Compatibility

There are five main inputs, composite video (RCA jack), S-video (4-pin mini-DIN), Input A and Input B (5 RCA jacks each), and an HDMI Digital input (HDMI connector). The composite input accepts virtually all world television standards. Input A and Input B can be configured for component, RGB-TV, or RGB-PC operation. The HDMI input accepts RGB digital signals and can be used with products having a DVI output by using a DVI to HDMI cable (not provided). Inputs A and B accept 480i, 480p, 720p, and 1080i as well as a large number of computer formats. The HDMI input accepts RGB 480p, 720p, 1080i, and computer formats.

Menus

The main menu is divided into four parts, the Image Menu, the Setup Menu, the Info Menu, and the Reset Menu. The main menu window can be located on any part of the screen, and a simplified line menu function is provided for frequently used picture adjustments. The menu system is extremely comprehensive and flexible. It is intuitive and easy to use, although my detailed description may make it seem complicated.

The Image Menu is divided into Picture Quality, Color Adjustment, Picture Mode, Memory Save, Auto Setup, and Reset. Picture Quality includes the Input parameters (White and Black Level), Iris, Color Intensity, Tint, and Sharpness. Tracking and Sync adjustments are provided for some input signals. Color Adjustment includes Absolute Color Temperature (500K increments from 5000K to 10000K), Flesh Tone (raises or lowers green), and an overall RGB adjustment for Offset, Gain, and Gamma (used to calibrate gray scale tracking). Picture Modes include Dynamic, Bright, Standard, Cinema, Cinema Black, or PC. Memory Save allows picture settings to be saved to any of six memories, which can be directly selected by dedicated buttons on the remote.

The Signal Menu is divided into Signal, Screen, Operation, User's Logo, On-Screen Display, Input Signal, Language, and Reset. Signal provides a choice of Film/Auto or forced Video Progressive modes. Motion Detection adjusts the video deinterlacer. Two levels of Noise Reduction plus Off can be selected. Overscan can be set to either 4 percent or 0 percent (default on HDTV is 0 percent). Setup Level can be set to 7.5 IRE or 0 IRE. The HDMI input can be set to Normal (maps video levels 16 to 235 to 0 to 255) or expanded (0 to 255).

Screen allows adjustment of Position, Caption Zoom, Electronic Keystone (normally not needed, and should be avoided to prevent artifacts), and Projection position (front floor, front ceiling, rear floor, rear ceiling). Operation includes Sleep Mode, Lamp Power, Standby Mode, Trigger Output, Settings Lock (Focus, Zoom, or Keylock), and LCD Panel Alignment. Any image can be captured and assigned as a User Logo. The On-Screen Display can be moved and its color changed. The Line Menu can be turned on or off, and the Menu Color can be changed. The Hide Screen can be Black, Blue, or the User Logo, and the Startup Screen can be turned on or off. Language and Reset are the final items in the Signal Menu.

The Info Menu displays the Lamp Hours, Source, and depending on the type of signal —Input Signal, Source Resolution, Refresh Rate, or Sync Mode.

The Reset Menu includes the lamp timer, picture memories, and a master reset.

Aspect Ratios

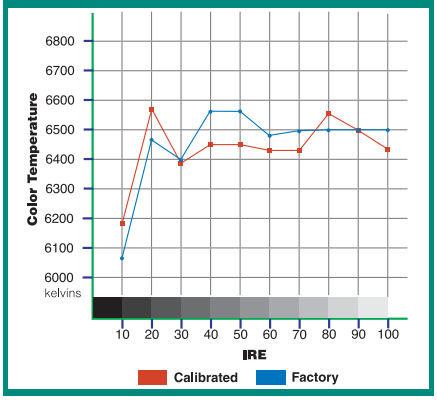
The aspect ratio choices are Normal, Squeeze, Zoom, Smart Zoom, Through, and Squeeze Through. Normal provides a 4:3 (1.33:1) windowboxed image when the source has a 4:3 aspect ratio, and provides a 16:9 (1.78:1) image on HDTV. The aspect ratio on HDTV is not adjustable (all HDTV is 1.78:1, even when displaying upconverted regular programs with side bars). Squeeze is the proper setting for 1.78:1 (anamorphic) DVDs. Zoom is the proper setting for 1.33:1 letterboxed DVDs. Smart Zoom is a modified geometry mode used to display 1.33:1 images using full screen width with minimal observed geometry distortion. Through and Through Squeeze are pixel-by-pixel mapped modes similar to Normal and Squeeze (for non HDTV images).

Scaling And Deinterlacing

Scaling and deinterlacing is excellent in all modes. A Genesis (Faroudja) DCDi™ chip is used for processing and contributes to the excellent performance. I viewed a variety of demanding deinterlacing test patterns on *AVIA PRO* and the Microsoft WHQL test discs and results were generally very good for both film and video sourced material. Identification of the 2-3 cadence and switching to film mode (inverse telecine) took about 0.25 seconds. I also viewed the "Montage Of Images" on the original *Video Essentials*, and the continual switching from video to film sourced material was seamless. I also viewed the Sony DRC demo disc, which is all HDTV video sourced material, downconverted for DVD, and results

Yamaha LPX-510
Gray Scale Tracking 720p HDMI

IRE	Factory °K	Calibrated °K	Factory dE	Calibrated dE
10	6065	6180	17	15
20	6465	6570	4	2
30	6396	6383	3	2
40	6562	6451	2	2
50	6562	6451	2	2
60	6477	6430	2	1
70	6492	6430	0	1
80	6499	6554	1	1
90	6499	6499	0	1
100	6499	6437	0	1



were excellent. Video sourced material cannot be deinterlaced perfectly because the two fields that make up an interlaced frame are captured 1/60 of a second apart, but the DCDi chip helped this projector also do a superior job on video.

Light Output, Contrast, And Colorimetry

During almost all of my viewing and testing, I used the projector in the Cinema Black mode at 75 percent lamp power. The iris is set to 75 percent in the Cinema Black mode and the Cinema Filter is active to balance the red, green, and blue light beams. All of these settings reduce the total light output, but the output was sufficient to produce a dynamic picture with about 25 foot-Lamberts from my Da-Lite High Power screen. Output was about 315 lumens and the on-off contrast ratio measured about 1050:1. The contrast ratio is the highest I have ever measured on a LCD projector. The lamp had 91 hours of use at the time of the measurements. These measurements were at D65 with the contrast control set to 0 for superb gray scale tracking, even at 100 IRE. No clipping occurred and gray scale tracking was still good slightly above 100 IRE, to allow for margin in program variation. If the contrast control is pushed higher, the projector will meet the Yamaha contrast spec of 1200:1. With the iris and lamp both at 100 percent, and the projector in the Bright mode, I measured a maximum output of 933 lumens with clipping at 100 IRE. With no clipping, output was about 560 lumens. The achievement of a true contrast ratio over 1000:1 at D65 with conservative settings represents a milestone for LCD projectors. I believe the contrast and black level of this projector will satisfy the great majority of viewers on virtually all images.

Colorimetry was excellent. All primaries and complements were close to HDTV and SMPTE (Society of Motion Picture and Television Engineers) standards. The red primary was highly saturated, not the orange red found on most consumer televisions. Green was accurate, not the yellow green found on some products. Blue was slightly more saturated than HDTV and SMPTE standards, but this never detracted from the image. Rich deep blue hues found in some stained glass windows and cobalt blue glassware was beautifully reproduced. In direct comparison with a direct view consumer TV set (Sony Trinitron), it was easy to see the difference in the blue primary. The consumer TV had a lighter, almost cyan blue and the projector had a much deeper blue.

Technical Performance Evaluation

NO CALIBRATION REQUIRED! As received this projector had almost perfect gray scale tracking to D65 when set to 6500K and Flesh Tone 3 in the user menu. From 70 to 100 IRE the delta E value was 0 or 1. From 40 to 100 IRE it was a maximum of 2, and from 20 to 100 IRE it never exceeded 4. I performed a calibration to see if I could improve the gray scale tracking and was able to achieve a value of D65 with a maximum delta E of 2, from 20 to 100 IRE. Observing test patterns and a variety of programs, these two calibrations looked essentially alike. In addition to an almost perfect gray scale, all settings for Black Level, White Level, Color, Tint, and Sharpness were either perfect, or had only the slightest error at the factory default settings. This is the first projector I have measured that was set this accurately from the factory. All measurements were taken using a 720p RGB digital signal fed to the HDMI input. Although not included, YPbPr results at 1080i and 480i were similar.

I ran extensive tests on all inputs except the S-video input. Anyone using the composite video input is in for a pleasant surprise. The 3D comb filter has superb performance. No cross-color was observed on static images, and the projector exhibited only minimal cross-color on moving test patterns. No dot crawl was observed. The composite video chroma response was the best I have ever measured, exhibiting good response to almost 2 MHz (0.5MHz is typical). There was no chroma delay with only minimal chroma smearing, and the color decoder had only very minor error. Luma response was excellent and easily reproduced the DVD limit of 720 lines per picture width.

Black level retention was essentially perfect on all inputs. It was refreshing to encounter menu items clearly specifying the selection of 7.5 IRE or 0 IRE black level. The white level control could be adjusted with absolutely no effect on the black level.

Input A, set to display component video, has superb performance at both 480i and 480p. The color decoding matrix and the chroma response were both excellent. The YPbPr sweep on *Digital Video Essentials*, and the many chroma tests on *AVIA PRO* were all reproduced flawlessly. Deinterlacing at 480i was superb. I felt the overall image quality from DVD was best using a Sony DVP-S9000ES, feeding 480i to Input A. Images from the Bravo D-1 feeding 720p to the HDMI input were almost as good. Only a tiny difference was observed. The Bravo is a flag reader, and doesn't fare as well with cadence problems and bad edits. It also exhibited slightly more artifacts. These were tiny differences; both units looked superb on good DVDs.

Input B, set to both YPbPr and RGB-TV, was tested on both 720p and 1080i using an AccuPel HDG-3000 test generator. Performance was very good, showing only the slightest roll-off at the highest frequencies using 720p. YPbPr was slightly better than RGB-TV. Aliasing was handled well and typical of the limitation of a 1280 pixel wide display.

With Input B set to RGB-TV, 1080i HDTV images from an RCA DTC-100 DirecTV Receiver looked superb. On standard definition material, the DTC-100 outputs a non-standard 540p format, which the LPX-510 recognized as 856 x 480. This caused the picture to be slightly too tall, clipping a little from the top and bottom. Using composite video from the DTC-100 when watching SDTV programs can avoid this minor glitch.

The HDMI input was fed a variety of test patterns and was essentially flawless and "pixel perfect" when the source resolution was 720p and overscan was set to 0 percent (default setting). On 1080i, 720p with overscan, and 480p there was only minor aliasing. High frequency response on the HDMI input was superior to that observed

on Input B (YPbPr or RGBTV) at the highest frequencies for both 720p and 1080i. HDMI overscan defaults to 0 percent on 480p, 720p, and 1080i. It is selectable and can easily be set to 4 percent if extraneous material is present in the program source. The default setting on other inputs is 4 percent, but 0 percent can be selected if desired.

Two menu choices are available for the HDMI video level, Normal and Expanded. Normal maps 16 to 235 digital video values to a range of 0 to 255, thus below black and above white signals cannot be reproduced. By using Expanded for digital video, 16 to 235 video is preserved as 16 to 235 and below black and above white signals in the range of 0 to 15 and 236 to 255 can be reproduced. When these settings are selected, a minor readjustment of the Black Level to –6 is required.

Subjective Picture Analysis

Almost all quality program material looked superb using any input. Accurate, noise free, gorgeous images were the norm, and all of this was achieved with no additional calibration. Calibration made tiny measurable improvements at low video levels, but did not noticeably change the appearance of DVD and HDTV images from the factory settings.

I watched a large amount of HDTV, and the images were superb. *Master And Commander* on DVD is a dark and gray movie, and it was reproduced well, even in the dark scenes. *Big Fish*, *Love Actually*, and *The Last Samurai* looked excellent. The Space Shuttle launch and Video Montage on the new *Digital Video Essentials* was rendered with beautiful, accurate colors. The Sony DRC Demonstration DVD looked superb, almost like HDTV except in wide-angle shots.

I'm extremely sensitive to rainbows and color flashes on DLP projectors, as well as the temporal dithering artifacts that are common to DLP. Even though I may not mention rainbows in reviews of DLP projectors, I always see them and their absence is welcome. This projector has none of the typical DLP artifacts that often distract me from the movie or HDTV program I am watching.

Several shows I watched on Discovery HD Theater looked almost like reality. HDTV produced as live or recorded video (*CSI*, *Tonight Show With Jay Leno*) look sharper, more noise free, and more detailed than the best films, but many films also looked superb. The highest compliment I can pay this projector is to say that it rendered a beautiful, accurate, noise free, and high-resolution picture—devoid of annoying artifacts—with adequate contrast ratio on a great majority of program material. It looked exactly as it should.

Summary

This is overall the best LCD projector I have tested. It is a breakthrough product offering wonderful flexibly of placement, truly useful features, comprehensive menu selections, excellent contrast, and terrific as-received calibration. It is extremely quiet and provides great value. Almost anyone looking for a fine home theatre projector will be thrilled with its performance.